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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/007,127	12/03/2001	Naoko Yamamoto	70551/56755	5908

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EDWARDS & ANGELL, LLP

P.O. BOX 9169

BOSTON, MA 02209

EXAMINER

HASSANZADEH, PARVIZ

ART UNIT

PAPER NUMBER

1763

DATE MAILED: 12/08/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/007,127

Applicant(s)

YAMAMOTO ET AL.

Examiner

Parviz Hassanzadeh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 17 October 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-5 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-5 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 03 December 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other:

DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-5 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In claim 1, line 10, the limitation "space wavelength of the dielectric" is vague as the dielectric does not have wavelength; however, the microwave has wavelength wherein its value is affected by the medium through which it travels. For the sake of the examination, the Examiner has interpreted the above limitation as the wavelength of the microwave in the dielectric window in contact with the slot antenna plate.

Further, the specification on page 9, lines 1-25, corresponding to page 7 of the applicants remarks, is also vague in defining the correlation between the wavelength of the length of the slot. For example, according to line 7 of specification, "the longer side of the rectangular slot of the slot antenna is $2/\lambda$ " rather than $\lambda/2$, that is, half length of the microwave wavelength in the dielectric window. It is further not clear whether the value of 20 mm, as recited on page 9, line 2 of the specification, is referring to the wavelength of the microwave in the dielectric window or the length of the slot.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are

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such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1, 2, 4, 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mabuchi et al (US Patent No. 5,645,644) in view of Yoshiki et al (US Patent No. 5,843,236).

Mabuchi et al teach a plasma processing apparatus (Fig. 10A) comprising:

a reaction chamber 1 (*a process chamber for processing by means of plasma*);

a waveguide 23 and a dielectric sheet 21 (*microwave transmission means for transmitting microwave to said process chamber*);

a microwave window 4 (*a dielectric for radiating the microwave transmitted by said microwave transmission means into said process chamber*); and

a window support member 5 having openings 6 formed in the shape of slit with the intention of improving the uniformity of plasma (*a slot antenna plate formed of conductor, placed on a side, facing said process chamber, of said dielectric, and including an opening for passing the microwave therethrough radiated from said dielectric*) (column 5, lines 28-64 and column 8, lines 33-51).

Mabuchi et al further discuss the minimum length of the opening in order to generate plasma efficiently (column 8, line 33 through column 9, line 43).

Mabuchi et al fail to explicitly disclose the length of the slit opening in terms of the wavelength of the microwave.

Yoshiki et al teach a microwave plasma processing system wherein the length of the slots are defined in term of wavelength of the microwave passing therethrough to be $n/2$ of a free-space wavelength of the microwaves in order to uniformly transmit microwaves into a process space (column 10, lines 12-26, column 19, lines 63-67, column 32, lines 8-11).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to optimize the slit dimension according to that taught by Yoshiki et al in order to generate plasma more efficiently and uniformly.

Further regarding claim 2: arrangement of the openings of the window support member (slot antenna plate) with respect to the location of the antinode of a standing wave is considered to have been obvious to one of ordinary skill in the art at the time of invention as Mabuchi et al further teach that the electric field in each slit opening 6 is intensified (column 8, lines 42-51).

Further regarding claims 4: Mabuchi et al in Fig. 10A teach all limitations of the claims as discussed above except for the window support member 5 (slot antenna plate) including a channel for process gas.

Mabuchi et al further in Fig. 7A teach that the window support member 5 may include gas inlets 41 provided in the beams 5b for improving the uniformity of plasma (column 7, lines 41-64).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to implement the gas inlets as taught in Fig. 7A in the apparatus of Fig. 10A in order to improve the uniformity of plasma.

Claims 1-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Katayama et al (US Patent No. 5,545,258) in view of Yoshiki et al (US Patent No. 5,843,236).

Katayama et al teach a plasma processing apparatus (Fig. 3) comprising:

- a reaction chamber 21 (*a process chamber for processing by means of plasma*);
- a waveguide 6 and a dielectric sheet 4 (*microwave transmission means for transmitting microwave to said process chamber*);
- a microwave introducing window 5 (*a dielectric for radiating the microwave transmitted by said microwave transmission means into said process chamber*); and
- a metal plate 11 having slit-like microwave transmission holes 12 as shown in Figs. 4A, 4B (*a slot antenna plate formed of conductor, placed on a side, facing said process chamber, of said dielectric, and including an opening for passing the microwave therethrough radiated from said dielectric*) (column 6, line 38 through column 8, line 8).

Katayama et al further disclose a slit having a size of 30 mm by 300 mm as an example (column 11, lines 1-10).

Katayama et al fail to disclose the length of the slit in terms of the wavelength of the microwave in the dielectric window.

Yoshiki et al teach a microwave plasma processing system wherein the length of the slots are defined in term of wavelength of the microwave passing therethrough to be $n/2$ of a free-space wavelength of the microwaves in order to uniformly transmit microwaves into a process space (column 10, lines 12-26, column 19, lines 63-67, column 32, lines 8-11).

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Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to optimize the slit dimension according to that taught by Yoshiki et al in order to generate plasma more efficiently and uniformly.

Further regarding claim 2: Katayama et al teach all limitations of the claims as discussed above except for explicit disclosure of the arrangement of the openings 12 of the metal plate 11 (slot antenna plate) with respect to the location of the antinode of a standing wave.

Arrangement of the openings 12 in the metal plate 11 with the antinode of standing wave is considered to have been obvious to one of ordinary skill in the art at the time of invention via routine optimization in order to allow transmission of microwave through the openings more efficiently.

Further regarding claims 3: the metal plate 11 serve as anode which is confronted with a cathode (sample holder 2a), the metal plate 11 is connected to ground via the reactor 1 (column 7, lines 1-13 and lines 59-63).

Further regarding claims 4: the metal plate 11 further includes a large number of small holes 13 through which process gases are introduced into the chamber (column 7, lines 40-58).

Response to Arguments

Applicant's arguments filed 10/17/03 have been fully considered but they are not persuasive.

Applicants assert that the newly amended claims require the opening of the slot antenna having a longer side with its length equal to half the space wavelength of the dielectric.

The Examiner argues that correlation between the dimension of the slit opening with the wavelength of the microwave passing therethrough is a well known parameter in the art and it

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would have been considered during designing the dimension of the slit opening. For example, Mabuchi et al discussed the minimum length of the opening in order to generate plasma efficiently (column 8, line 33 through column 9, line 43). In brief, optimization of the slit dimension is considered to have been obvious to one of ordinary skill in the art at the time of the invention in order to generate plasma efficiently. However, new prior art are used to show that correlation between the length of the slot and the wavelength of the incident wave is well known and is considered when designing slot antenna.

It is further noticed that the present claims do not specify the direction of the propagation of microwave with respect to the surface of the dielectric window being vertical or horizontal.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

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The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Akimoto (US Patent No. 5,614,025) teach a microwave plasma reactor (Fig.2) including an upper electrode 42 placed on the surface of a microwave transmission dielectric plate 40, wherein the conductive member is also coupled to a DC power source 52;

Engemann et al (US Patent No. 5,517,085) teach a microwave plasma source wherein the length of the slot is set to be equal to half free-space wavelength of the microwave (column 7, lines 11-13).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Parviz Hassanzadeh whose telephone number is (571)272-1435 or (703)308-2050. The examiner can normally be reached on Tuesday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory Mills can be reached on (703)308-1633. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9306 for regular communications and (703) 872-9306 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0661.

P. Hassanzadeh

Parviz Hassanzadeh
Primary Examiner
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December 2, 2003